

29 IAP20 Rec'd PCT/PTO 21 DEC 2005

CLAIMS

1. Tyre for vehicle wheels comprising:

- a carcass structure with at least one carcass ply shaped in a substantially toroidal configuration, the opposite lateral edges of which are associated with respective right-hand and left-hand bead wires, each bead wire being enclosed in a respective bead;
- a belt structure comprising at least one belt strip applied in a circumferentially external position relative to said carcass structure;
- a tread band superimposed circumferentially on said belt structure comprising a radially outer layer designed to come into contact with the ground and a radially inner layer interposed between said radially outer layer and said belt structure;
- a pair of sidewalls applied laterally on opposite sides relative to said carcass structure;

in which said radially inner layer includes a crosslinked elastomeric composition comprising:

- (a) at least one diene elastomeric polymer;
- (b) at least one layered inorganic material having an individual layer thickness of from 0.01 nm to 30 nm.

2. Tyre for vehicle wheels according to claim 1, wherein the layered inorganic material (b) has an individual layer thickness of from 0.05 nm to 15 nm.

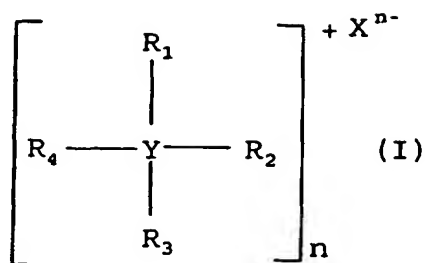
3. Tyre for vehicle wheels according to claim 1 or 2, wherein the radially inner layer is formed by a crosslinked elastomeric composition having a dynamic elastic modulus (E'), at 23°C, of from 10 MPa to 30 MPa.

4. Tyre for vehicle wheels according to claim 3,

wherein the radially inner layer is formed by a crosslinked elastomeric composition having a dynamic elastic modulus (E'), at 23°C, of from 15 MPa to 20 MPa.

- 5 5. Tyre for vehicle wheels according to any one of the preceding claims, wherein the radially inner layer has a thickness of at least 10% with respect to the total thickness of the tread band.
- 10 6. Tyre for vehicle wheels according to claim 5, wherein the radially inner layer has a thickness of between 20% and 70% with respect to the total thickness of the tread band.
- 15 7. Tyre for vehicle wheels according to any one of the preceding claims, wherein the layered inorganic material (b) is present in the elastomeric composition in an amount of from 1 phr to 120 phr.
- 20 8. Tyre for vehicle wheels according to claim 7 wherein the layered inorganic material (b) is present in the elastomeric composition in an amount of from 5 phr to 80 phr.
- 25 9. Tyre for vehicle wheels according to any one of the preceding claims, wherein the layered inorganic material (b) is selected from phyllosilicates such as: smectites, for example, montmorillonite, nontronite, beidellite, volkonskoite, hectorite, saponite, sauconite; vermiculite; halloisite; sericite; or mixtures thereof.
- 30 10. Tyre for vehicle wheels according to claim 9, wherein the layered inorganic material (b) is montmorillonite.
11. Tyre for vehicle wheels according to claim 9 or 10, wherein the layered inorganic material (b) is surface-treated with a compatibilizer.
- 35 12. Tyre for vehicle wheels according to claim 11, wherein the compatibilizer is selected from the quaternary ammonium or phosphonium salts having

general formula (I):



wherein:

- Y represents N or P;
 - 5 - R_1 , R_2 , R_3 and R_4 , which may be identical or different, represent a linear or branched C_1 - C_{20} alkyl or hydroxyalkyl group; a linear or branched C_1 - C_{20} alkenyl or hydroxyalkenyl group; a group $-R_5$ -SH or $-R_5$ -NH wherein R_5 represents a linear or branched C_1 - C_{20} alkylene group; a C_6 - C_{18} aryl group; a C_7 - C_{20} arylalkyl or alkylaryl group; a C_5 - C_{18} cycloalkyl group, said cycloalkyl group possibly containing hetero atom such as oxygen, nitrogen or sulphur;
 - 10 - X^{n-} represents an anion such as the chlorine ion, the sulphate ion or the phosphate ion;
 - 15 - n represents 1, 2 or 3.
13. Tyre for vehicle wheels according to any one of the preceding claims, wherein the diene elastomeric polymer (a) has a glass transition temperature below 20°C .
- 20 14. Tyre for vehicle wheels according to claim 13, wherein the diene elastomeric polymer (a) is selected from: cis-1,4-polyisoprene, 3,4-polyisoprene, polybutadiene, optionally halogenated isoprene/isobutene copolymers, 1,3-butadiene/acrylonitrile copolymers, styrene/1,3-butadiene copolymers, styrene/isoprene/1,3-butadiene copolymers, styrene/1,3-butadiene/acrylonitrile copolymers, or mixtures thereof.
- 25 30

15. Tyre for vehicle wheels according to any one of the preceding claims, wherein the elastomeric composition comprises at least 10% by weight with respect to the total weight of the at least one diene elastomeric polymer (a) of natural rubber.
16. Tyre for vehicle wheels according to claim 15, wherein the elastomeric composition comprises between 20% by weight and 90% by weight with respect to the total weight of the at least one diene elastomeric polymer (a) of natural rubber.
17. Tyre for vehicle wheels according to any one of the preceding claims, wherein the elastomeric composition further comprises at least one elastomeric polymer of one or more monoolefins with an olefinic comonomer or derivatives thereof (a').
18. Tyre for vehicle wheels according to claim 17, wherein the elastomeric polymer (a') is selected from: ethylene/propylene copolymers (EPR) or ethylene/propylene/diene copolymers (EPDM); polyisobutene; butyl rubbers; halobutyl rubbers; or mixtures thereof.
19. Tyre for vehicle wheels according to any one of the preceding claims, wherein the elastomeric composition further comprises at least one carbon black filler (c).
20. Tyre for vehicle wheels according to claim 19, wherein the carbon black filler (c) has a surface area of not less than 20 m²/g (determined by CTAB absorption as described in ISO standard 6810).
21. Tyre for vehicle wheels according to claim 19 or 20, wherein the carbon black filler (c) is present in the elastomeric composition in an amount of from 0.1 phr to 120 phr.
22. Tyre for vehicle wheels according to claim 21, wherein the carbon black filler (c) is present in the elastomeric composition in an amount of from 20

phr to 90 phr.

23. Tyre for vehicle wheels according to any one of the preceding claims, wherein the elastomeric composition further comprises at least one silane coupling agent (d).

24. Tyre for vehicle wheels according to claim 23, wherein the silane coupling agent (d) is selected from those having at least one hydrolizable silane group which may be identified by the following general formula (II):



wherein the groups R, which may be identical or different, are selected from: alkyl, alkoxy or aryloxy groups or from halogen atoms, on condition that at least one of the groups R is an alkoxy or aryloxy group; n is an integer between 1 and 6 inclusive; X is a group selected from: nitroso, mercapto, amino, epoxide, vinyl, imide, chloro, $-(S)_mC_nH_{2n}-Si-(R)_3$ in which m and n are integers between 1 and 6 inclusive and the groups R are defined as above.

25. Tyre for vehicle wheels according to claim 23 or 24, wherein the silane coupling agent (d) is present in the elastomeric composition in an amount of from 0.01 phr to 10 phr.

26. Tyre for vehicle wheels according to claim 25, wherein the silane coupling agent (d) is present in the elastomeric composition in an amount of from 0.5 phr to 5 phr.

27. Tyre for vehicle wheels according to any one of the preceding claims, wherein at least one additional reinforcing filler is present, in an amount of from 0.1 phr to 120 phr, in the elastomeric composition.

28. Tyre for vehicle wheels according to claim 27, wherein the reinforcing filler is silica.

29. Tyre for vehicle wheels according to claim 28,

wherein at least one silane coupling agent (d) is present.

30. Tyre for vehicle wheels according to any one of the preceding claims, wherein the radially outer layer of the tread band is formed by a crosslinked elastomeric composition having a dynamic elastic modulus, at 0°C, of from 5 MPa to 15 MPa.

31. Tyre for vehicle wheels according to claim 30, wherein the radially outer layer of the tread band is formed by a crosslinked elastomeric composition having a dynamic elastic modulus, at 0°C, of from 8 MPa to 10 MPa.

32. Process for manufacturing a tyre for vehicle wheels, said process comprising the following steps:

- manufacturing a green tyre by assembling at least one carcass ply, a belt structure in a circumferentially outer position with respect to said carcass ply, a tread band in a circumferentially outer position with respect to said belt structure, said tread band comprising a radially outer layer designed to come into contact with the ground and a radially inner layer interposed between said radially outer layer and said belt structure;
- subjecting the green tyre to moulding in a mould cavity formed in a vulcanization mould;
- subjecting said green tyre to crosslinking by heating;

wherein said radially inner layer includes a crosslinkable elastomeric composition comprising:

- (a) at least one diene elastomeric polymer;
- (b) at least one layered inorganic material having an individual layer thickness of from 0.01 nm to 30 nm.

33. Process for manufacturing a tyre for vehicle wheels

according to claim 32, wherein the layered inorganic material (b) has an individual layer thickness of from 0.05 nm to 15 nm.

- 5 34. Process for manufacturing a tyre for vehicle wheels according to claim 32, wherein the radially inner layer is obtained by winding at least one ribbon-like strip consisting of a crosslinkable elastomeric composition comprising:
- 10 (a) at least one diene elastomeric polymer;
- (b) at least one layered inorganic material having an individual layer thickness of from 0.01 nm to 30 nm;
- in side by side coils.
- 15 35. Process for manufacturing a tyre for vehicle wheels according to claim 34, wherein the layered inorganic material (b) has an individual layer thickness of from 0.05 nm to 15 nm.
- 20 36. Process for manufacturing a tyre for vehicle wheels according to any one of claims 32 to 35, wherein the layered inorganic material (b) is defined according to any one of claims 7 to 12.
- 25 37. Process for manufacturing a tyre for vehicle wheels according to any one of claims 32 to 36, wherein the diene elastomeric polymer (a) is defined according to any one of claims 13 to 16.
- 30 38. Process for manufacturing a tyre for vehicle wheels according to any one of claims 32 to 37, wherein the elastomeric composition further comprises at least one elastomeric polymer of one or more monoolefins with an olefinic comonomer or derivatives thereof (a') as defined according to claim 18.
- 35 39. Process for manufacturing a tyre for vehicle wheels according to any one of claims 32 to 38, wherein the elastomeric composition further comprises at least one carbon black filler (c) as defined

according to any one of claims 20 to 22.

- 5 40. Process for manufacturing a tyre for vehicle wheels according to any one of claims 32 to 39, wherein the elastomeric composition further comprises at least one coupling agent (d) as defined according to any one of claims 24 to 26.
- 10 41. Process for manufacturing a tyre for vehicle wheels according to any one of claims 32 to 40, wherein at least one additional reinforcing filler is present, in an amount of from 0.1 phr to 120 phr, in the elastomeric composition.
42. Process for manufacturing a tyre for vehicle wheels according to claim 41 wherein the reinforcing filler is silica.
- 15 43. Process for manufacturing a tyre for vehicle wheels according to claim 42, wherein at least one silane coupling agent (d) is present.

20

25

30

35